



SUSTAINICUM COLLECTION
LEHRMATERIALIEN FÜR BILDUNG ZUR NACHHALTIGKEIT

Modeling potential negative effects of a nuclear accident on the environment and humans using a new qualitative modeling software (DynaLearn)

(Resource ID: 195)

DI DR. Andreas Zitek, MSc

Andreas Zitek

andreas.zitek(at)boku.ac.at

This teaching resource is allocated to following University:

BOKU - University of Natural Resources and Life Sciences Vienna

<http://sustainicum.at/en/modules/view/195.Modeling-potential-negative-effects-of-a-nuclear-accident-on-the-environment-and-humans-using-a-new-qualitative-modeling-software-DynaLearn>





Individual work
Work in pairs



5 to 10 students
More than 10 students



Up to 3 lecture units



Internet connection necessary



English

The high number of existing nuclear power plants worldwide are representing an enormous risk for the environment and humans. This has become obvious during the Chernobyl and Fukushima accidents. And although, due to the operation of nuclear power plants worldwide, there is still not a single secure storage site for nuclear waste existing. Lobbyists enforcing nuclear power production still neglect the fact, that severe nuclear accidents cannot be controlled by humans, and that the problem of nuclear waste storage is still not solved. This learning activity should draw the attention towards the potential negative effects of an accident at a nuclear power plant on environment and humans. A new software tool (DynaLearn) for qualitative conceptual model building and simulation is introduced, aiming at enriching and restructuring the conceptual way students look at environmental problems by a combination of Qualitative Reasoning and Semantic Technology.

Unsustainable ways of producing energy, like nuclear fission in reactors, are posing severe threats to the environment and humans. For a sustainable management, on the first hand it

is required build up a responsible viewpoint based on the “precautionary principle”. That’s why education is considered as a major basis for any successful democratic society. A causal understanding of the potential negative effects of nuclear power production, especially in case of an accident, supports the development of an informed viewpoint, which in turn forms the basis for democratic decisions.

This learning activity focuses on the development of basic causal models on the effects of a nuclear accident on the environment and humans. A new software tool (DynaLearn) for qualitative conceptual model building and simulation is introduced, aiming at restructuring the conceptual way students look at environmental problems.

DynaLearn represents an Intelligent Learning Environment that allows learners to acquire conceptual knowledge by constructing and simulating qualitative models about systems. DynaLearn uses specific modeling language elements similar to Systems Dynamics (state variables, rates etc.). But in contrast to System Dynamic software tools it is purely qualitative. This means that no numbers are required for modeling and simulation, and models are purely based on a conceptual causal understanding of the system. DynaLearn contains six distinct Learning Spaces which act as scaffolds to support learners in developing their conceptual knowledge. These Learning Spaces are organized hierarchically with increasing complexity. In addition DynaLearn is equipped with following semantic technology components:

Grounding of model terms by linking them to common vocabularies.

Modeling recommendations from a remote database, which are generated by a comparison of the learner model with models in the repository.

The diagnostic component helps learners to ultimately arrive at a model that matches their

expectations.

Virtual characters interacting with the students in various ways, e.g. for giving support for model building, for running knowledge quizzes or as teachable agent.

Evaluation studies conducted proved that the DynaLearn approach represents a powerful tool for supporting the growth of causal systems thinking, the acquisition of scientific reasoning skills, the ability to learn about complex ecosystems, the gradual construction of content knowledge and the incremental development of the conceptual modeling approach and skills. However, it has to be noted, that this new modeling approach is still under research and development. Therefore, conducting learning activities with DynaLearn requires interest in the application of new technologies in classrooms and some preparation of the teacher to successfully run a course. This is the first time that a comprehensive guideline for using DynaLearn in regular courses is being presented to the public.

Teaching Tools & Methods



Simulation program

Contact details for borrowing physical devices

Konrad-Lorenz-Straße 24;

Learning Outcomes

Learning about the potential negative effects of nuclear accidents on the environment and humans. Development of a systems view of the world along with the use of a new qualitative conceptual causal simulation tool – the DynaLearn software. Learning a way of structured causal environmental problem analysis.

Relevance for Sustainability

The development of a causal systems view of the world including human behavior and the potential negative effects of unsustainable ways of energy production using nuclear fission on the environment and humans. The problem of potential negative impacts of nuclear accidents is of high contemporary interest.

Related Teaching Resources

No specific previous knowledge / related resources required

Sustainability criteria

- Related to global challenges / needs
- Application oriented

- Related to acquiring skills
- Problem-solving oriented

Preparation Efforts

Medium

Access

Free

Sources and Links

<http://hcs.science.uva.nl/projects/DynaLearn/>

Funded by

Funded by the Austrian Federal Ministry of Science and Research within the framework of the call "Projekt MINT-Massenfächer" (2011/12)